



Operating & troubleshooting a T-piece device: Neopuff™ Infant Resuscitator

Presentation developed by Rosemarie Boland
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Aims & objectives

- This presentation has been designed to assist you to:
 - Assemble the Neopuff™ T-piece device
 - Set the recommended flow rate & pressures
 - Operate the Neopuff™ T-piece device
 - Troubleshoot the Neopuff™ T-piece device
- We suggest that you print a copy of this presentation and have the Neopuff™ at hand to practice each action

Manual ventilation devices

The ARC Neonatal Guidelines state:

“A self inflating bag, a flow inflating bag or a T-piece device are all acceptable devices which can be used to ventilate newborn infants either via a face mask or via an endotracheal tube”.

(ARC, 2006, Guideline 13.4)

T-piece device (e.g. Neopuff™ Infant Resuscitator)

Advantages of using a T-piece device

- The operator sets the peak inspiratory pressure (PIP) & positive end expiratory pressure (PEEP)
- The T-piece device will not deliver PIP or PEEP/CPAP above the set pressures if the flow remains constant
- The PIP & PEEP are displayed on the manometer
- The operator can control the length of the inspiratory time by varying the duration of occlusion of the PEEP cap

Positive end expiratory pressure

T-piece device

Can provide CPAP
or PEEP

Self inflating bag

Does not deliver
CPAP or PEEP*

* Unless a PEEP valve has been fitted

Why is PEEP so important?

- It assists with lung expansion
- It helps to establish functional residual capacity
- It leads to improved oxygenation, especially in very premature infants

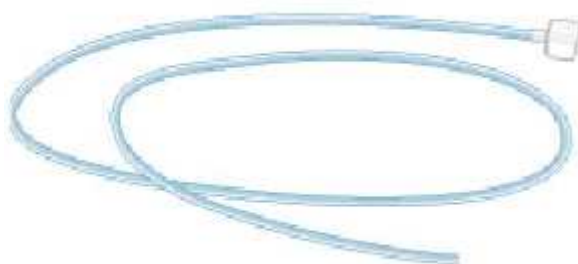
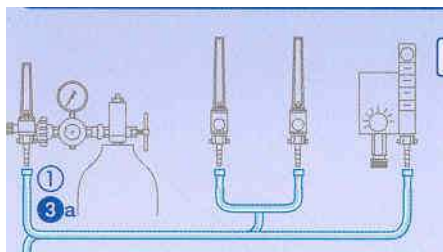
Setting up the Neopuff™

To check & set the Neopuff™ you will need:

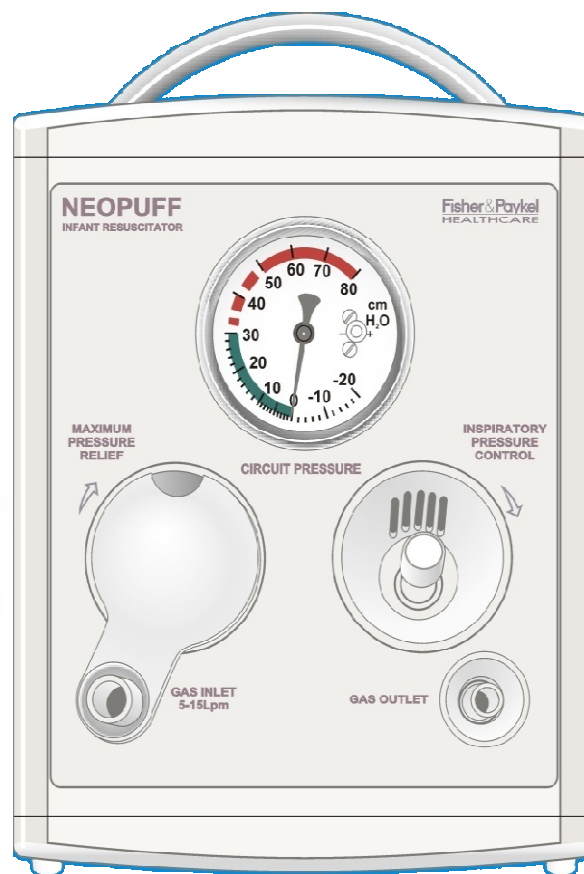
- A Neopuff™ Infant Resuscitator
- A compressed gas source
- A gas supply line (green oxygen tubing) with the plastic connector (supplied)
- The patient supply line (tubing & T-piece)
- A test lung

The components of the Neopuff™

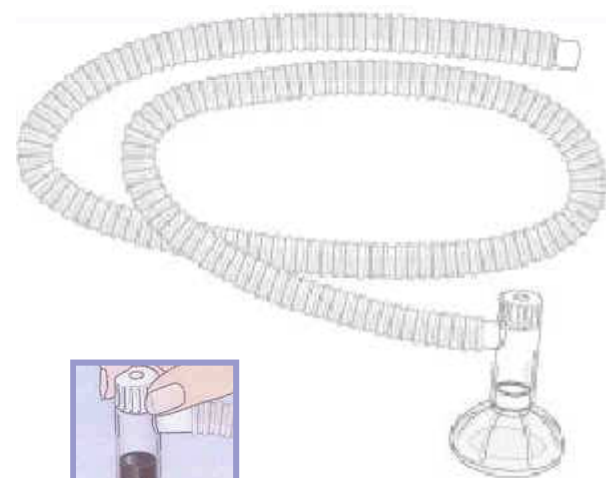
Gas supply



Gas supply line



Patient supply line
with T-piece & mask



Test lung

Which gas: Air or oxygen?

The ARC recommend:

- Use air (21%) initially
- If there is no improvement in condition within the first minutes of life, then introduce supplementary oxygen (ARC, 2006: Guideline 13.4)
- N.B: Unless an air & an oxygen cylinder (+/- a blender) is available, you will have to use 100% O₂ when using the Neopuff™

Recommended settings

- Gas flow rate
 - Set at 8 L/min
- Maximum pressure relief valve
 - Set at 50 cm H₂O
- Peak inspiratory pressure (PIP)
 - Set at 30 cm H₂O
- Positive end expiratory pressure (PEEP)
 - Set at 5 cm H₂O

(ARC, 2006: Guideline 13.4)

Setting up the Neopuff:6 steps

Step 1

- Connect the gas supply line to the gas inlet and the patient supply line to the gas outlet

Step 2

- Attach a test lung to the end of the patient supply line and turn the gas flow to 8 L/min

Step 3

- Check the maximum pressure relief is set at 50 cm H₂O (adjust as necessary)

Setting up the Neopuff: 6 steps

Step 4

- Set the peak inspiratory pressure (PIP) to 30 cm H₂O

Step 5

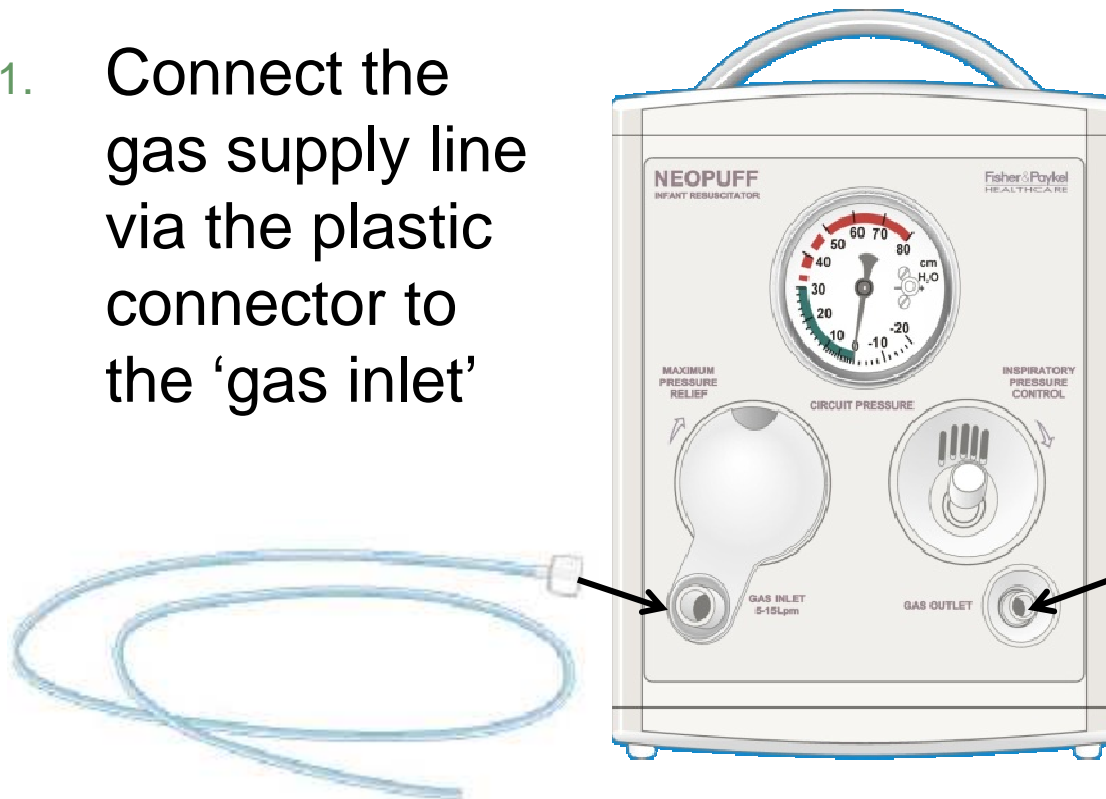
- Set the positive end expiratory pressure (PEEP) to 5 cm H₂O

Step 6

- Create a good seal between the infant's face & the face mask using the "two point top hold"

1. Connect the gas & patient supply lines

1. Connect the gas supply line via the plastic connector to the 'gas inlet'



2. Connect the patient supply line to the 'gas outlet'

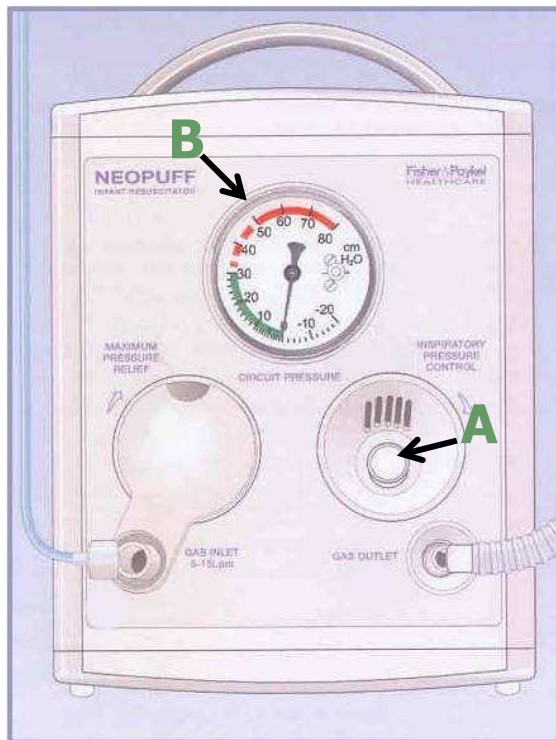


2. Attach the test lung

- Attach the test lung to the end of the patient supply line (patient T-piece)
- It is much easier to use the test lung (as opposed to a face mask or the ball of your hand) to set and test the Neopuff™
- Turn the gas flow to 8 L/min

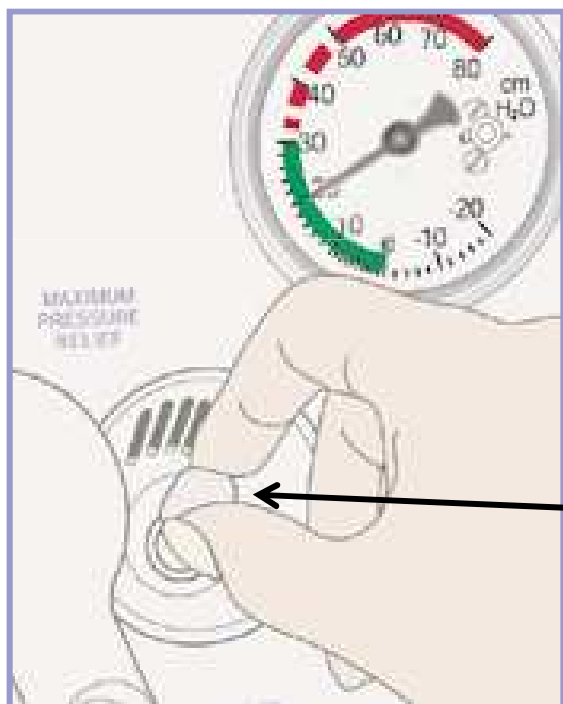


3. Check the maximum pressure has been pre-set to 50 cm H₂O



1. Turn the inspiratory pressure control dial fully clockwise until it cannot turn any further (A)
2. Occlude the PEEP cap on the patient T-piece
3. Look at the manometer & check that the pressure gauge points to 50 cm H₂O. (B) If it does, then the maximum pressure is set correctly
 - If it is not 50 cm H₂O, you will need to adjust it (See following slide)

Adjusting the maximum pressure



Once the inspiratory pressure control dial is fully open:

1. Occlude the PEEP cap on the patient T-piece
2. Open the cap covering the maximum pressure relief
3. Turn the maximum pressure relief dial clockwise or anti-clockwise to adjust the pressure to 50 cm H₂O
4. Close the max. pressure relief cap

4. Set the peak inspiratory pressure (PIP)



1. Occlude the PEEP cap on the end of the patient T-piece
2. Turn the inspiratory pressure control anti-clockwise (several times) to decrease the pressure from 50 cmH₂O down to 30 cm cmH₂O
3. The set PIP is displayed on the manometer when the PEEP cap on the patient T-piece is occluded

5. Set the positive end expiratory pressure (PEEP)

- Set the PEEP by turning the cap on the patient T-piece clockwise or anti-clockwise until a PEEP of 5 cm H₂O is displayed on the manometer
- Caution: If the PEEP has been set on a flow rate of 8 L/min, any increase in the flow rate will result in a dangerously high increase in PEEP (Morley, Schmolzer & Davis, 2009)
- If you change the flow rate, then re-set and re-check the PEEP



6. Create a good seal between the infant's face & the mask neoResus The Victorian Newborn Resuscitation Project

- Remove the test lung & attach a face mask to the patient T-piece
- Position the infant's head in a neutral position
- Place a finger onto the chin tip (the "guide finger")
- Line up the outer edge of the mask into the groove between the guide finger and the chin tip
- Roll the mask onto the face from the chin upwards



Holding the mask in place using the “two point top hold”

- Apply evenly balanced downward pressure onto the mask using the thumb and index finger positioned toward the outer edge of the flat area of the mask (“two point top hold”)
- Apply jaw lift with the remaining fingers so that the upward pressure works against the downward pressure from the two point top hold to create a good seal



The two point top hold

Wood, et al. (2008).
*Archives of Disease in Childhood, Fetal
& Neonatal Edition 93*, p. F231

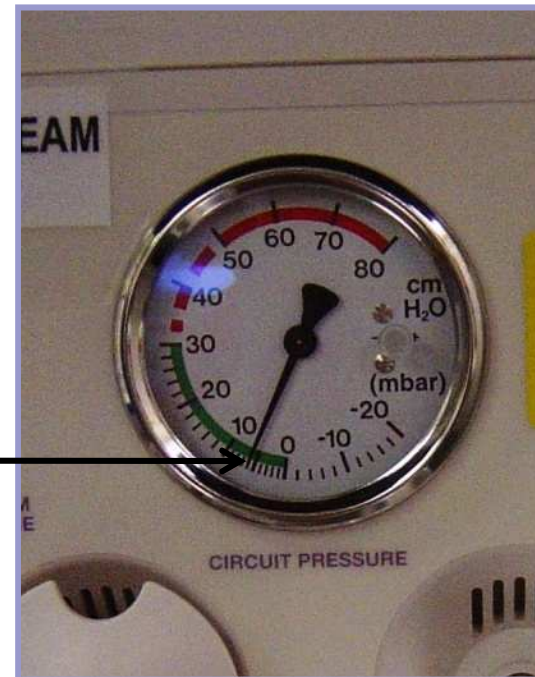
Checking the face mask seal: “Listen & look” technique

Listen for a soft whistle of gas through the PEEP cap



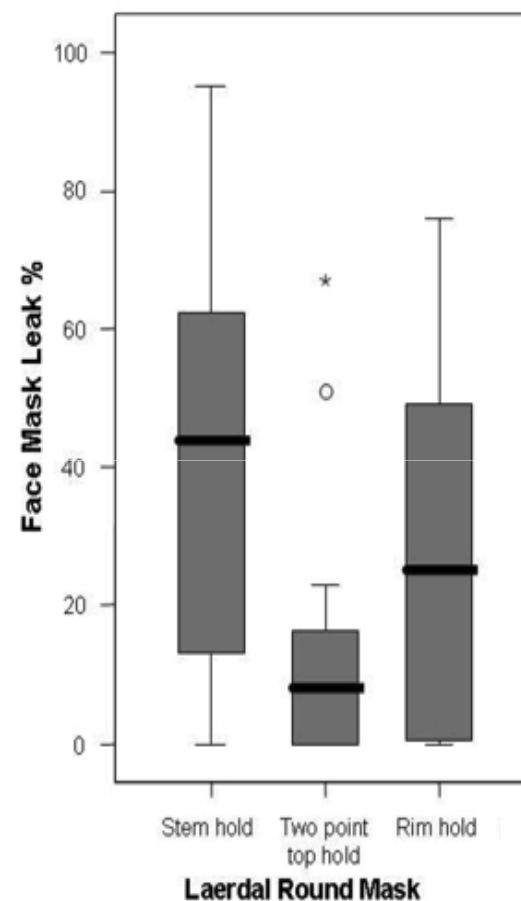
Look that a PEEP of 5 cm H₂O is displayed on the manometer

5 cm H₂O



Face mask leak

- Leaks averaging 40 to 70% around face masks are common due to poor mask placement technique & the manner in which the mask is held (see box plots)
- Be aware that a PIP of 30 cm H₂O may be reached on the manometer **despite a leak of up to 90%** Wood, et al. (2008)



Wood, et al. (2008)
Archives of Disease in Childhood, Fetal & Neonatal Edition, 93, p. F231

Delivering positive pressure inflations with the Neopuff™

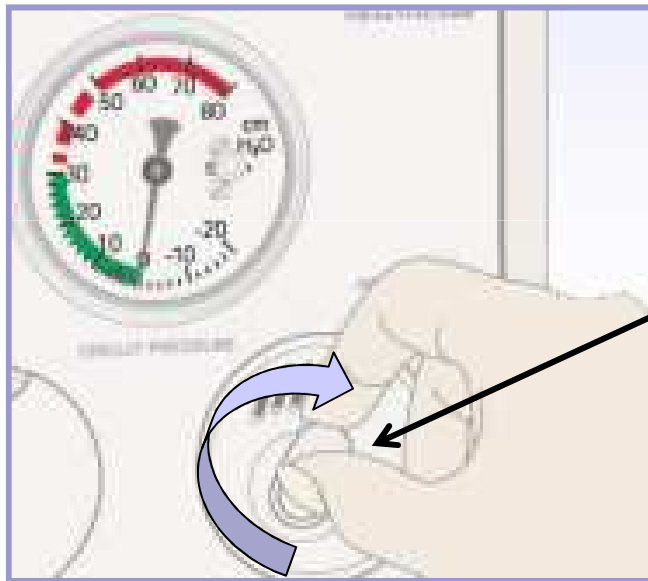
- Occlude the PEEP cap using your thumb or finger for 0.5 seconds, then release for 0.5 seconds
- This will provide a ventilation rate of 60 inflations per minute
- Continue to check your mask seal by checking that the PEEP/CPAP returns to 5 cm H₂O on the manometer after each manual inflation



Initial inflations

- Higher inflation pressures (PIP > 30 cm H₂O) may be needed for the initial inflations
- Subsequent inflations usually require less pressure, although some babies may need higher inflation pressures (higher PIP)
- **Improvement in heart rate** is the primary measure of adequate ventilation
- If heart rate is not improving, assess chest wall movement. Higher PIP may be required

Adjusting the PIP whilst using the Neopuff

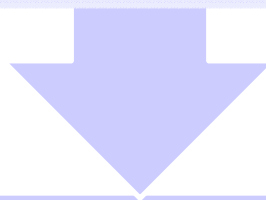


- Higher pressure inflations can be given by increasing the inspiratory pressure control to deliver higher PIP
- This can be changed while resuscitating, but requires a second person to achieve this efficiently

Common problems & solutions

Unable to achieve the desired PIP & PEEP when checking the Neopuff™ with the test lung

Check that the gas flow rate is set to 8 L/min and that there is gas flow through the Neopuff™ circuit



Still unable to achieve the desired PIP & PEEP when checking the Neopuff™ with the test lung

Check the maximum pressure relief is set correctly at 50 cm H₂O and adjust if necessary

Common problems & solutions

Unable to achieve the set PIP when ventilating the infant

Check the face mask seal using the “look and listen technique”



Still unable to achieve the set PIP

Reposition the infant's head and apply the face mask again



Still unable to achieve the set PIP

Consider intubation if mask ventilation is unsuccessful

Most importantly: look at the baby, not at the manometer!

- Effective ventilation is confirmed by:
 1. An increase in the heart rate above 100 bpm
 2. A rise of the chest & upper abdomen with each inflation

- Achieving the set PIP on the manometer is **not** a sign of effective ventilation:
 - A PIP of 30 cm H₂O on the manometer can be achieved with leaks of up to 90% (Wood, et al., 2008)

Remember!

- If the heart rate remains < 100 bpm and/or the chest is not moving despite ventilating with good technique:

TURN UP THE PEAK PRESSURE (PIP)

30 \rightarrow 40 \rightarrow 50 \rightarrow 60 cm H₂O

- Continue to provide positive pressure ventilation until the heart rate is above 100 bpm and the infant has established effective spontaneous respirations
- Endotracheal intubation should be considered if ventilation via a face mask is unsuccessful

References

- Australian Resuscitation Council (2006). *Guideline 13.4: Airway management and mask ventilation of the newborn infant*. Accessed December 10, 2009 from <http://www.resus.org.au>
- Fisher & Paykel Healthcare. (2004). *Neopuff™ Infant Resuscitator. Optimal resuscitation in neonatal care*. Auckland, New Zealand
- Morley, C.J., Schmolzer, G.M., & Davis, P.G. (2009). Potential hazards of the Neopuff: using appropriate gas flow. *Archives of Disease in Childhood- Fetal and Neonatal Edition*, 94, F467 - F468.
- Wood, F.E., Morley, C.J., Dawson, J.A., Kamlin, C.O., Owen, L.S., Donath, S., & Davis, P.G. (2008). Improved techniques reduce face mask leak during simulated neonatal resuscitation. Study 2. *Archives of Disease in Childhood: Fetal & Neonatal Edition*, 93: F230 - F234.

Acknowledgements

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- The Neopuff colour diagrams have been reproduced with the kind permission of Fisher & Paykel Healthcare: Australia and New Zealand

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